

Full Length Research Paper

Planet Earth in the 21st century: Coordination failure in common pools governance?

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Received 22 September 2014; Accepted 19 March 2015

Marx argued, we recall that capitalist society suffered from in-built contradictions, which would lead to its demise in time. Today, the globe faces another major kind of contradiction: rapid economic development against ecological sustainability. The relationships between economic growth and environmental sustainability have been much debated: Can they be combined to give both prosperity and environmental protection? On the micro level, many projects show that this is indeed possible. But on the macro level, global emissions of greenhouse gases follow the advancement of country affluence closely. The link is the constantly increasing need for more energy, provided by fossil fuels.

Key words: Ecological sustainability, greenhouse gases, GDP total and per capita, energy consumption, economic growth versus environment sustainability: micro versus macro aspects.

INTRODUCTION

Economists and environmentalists alike underline that there is in principle no contradiction between economic growth on the one hand and preservation of the environment on the other hand. And they go on to offer many examples of innovations that foster both growth and ecology concerns. Thus, Singapore for instance has spearheaded several forms of economic development and economic growth that are also environmentally sustainable. And an entire city in China has been built upon the use of renewable sun energy. Moreover, almost all car makers have planned for the construction of electricity or hydrogen cars. And many urban sites employ so-called green buses.

This feasible coherence between economic growth and environmental sustainability holds at the micro level in the economy, encompassing lots of interesting and promising

projects, especially in rich countries. However, at the macro level, especially at the global level, matters are entirely different, as economic activity in general consumes lots of energy, which results in a constantly increasing emission of greenhouse gases. This global contradiction between economic growth and ecological sustainability, both valued by many people, will most probably be the major headache of the 21st century, because there is a limit to the increase in CO₂ equivalent emissions, as far as climate change is concerned. Too much global warming may change the basic living conditions on the planet Earth.

The aim of this short research note is merely to pin down exactly these macro relationships between economic activity, energy consumption and greenhouse gases, as they hold for the Planet Earth today when

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Table 1. Economic affluence in the 21st century (LN GDP per capita in constant value 2005 USD).

| Year | 2000 | 2003 | 2006 | 2009 | 2013 |
|----------------|------|------|------|------|------|
| Euro area | 10,3 | 10,3 | 10,4 | 10,3 | 10,4 |
| European Union | 10,2 | 10,2 | 10,2 | 10,2 | 10,3 |
| Brazil | 8,39 | 8,40 | 8,49 | 8,57 | 8,67 |
| India | 6,36 | 6,47 | 6,68 | 6,85 | 7,06 |
| China | 7,02 | 7,26 | 7,57 | 7,87 | 8,18 |
| United States | 10,6 | 10,6 | 10,7 | 10,7 | 10,7 |

Source: World Bank.

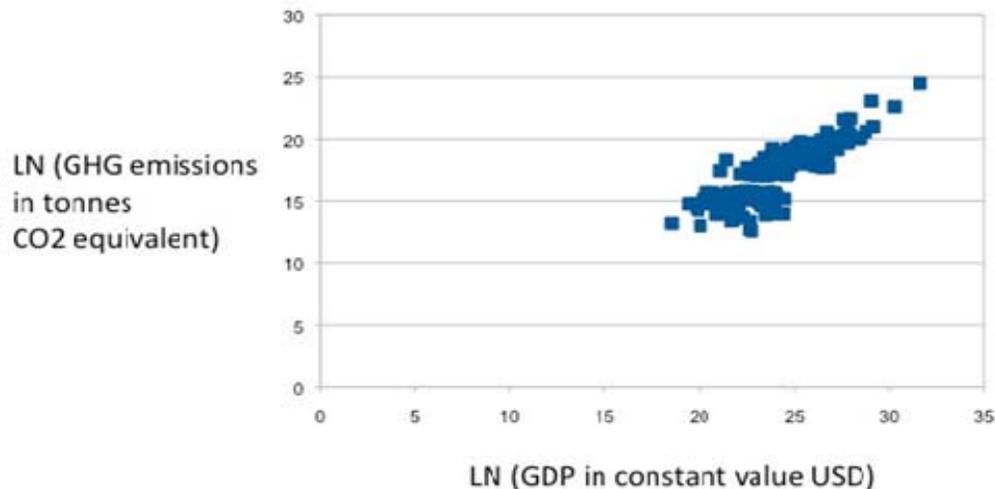


Figure 1. Total emissions and GDP: Equation: LN GDP - LN GHG total : $y=0.81x$, $R^2 = 0.708$. Note: GDP vs. Greenhouse emissions for 158 countries in 2011. Sources: 1. World Bank Open Data, <http://data.worldbank.org>. 2. CAIT WRI 2.0: Climate Data Explorer, World Resources Institute, <http://cait2.wri.org>

measured at total or aggregated levels.

The relevance of economic growth

Economists and politicians emphasize the need for balanced growth on many occasions. Zero economic growth has been pledged by a small group of people, talking about the global limits to growth. They are often rebutted by the argument that growth and environment do not necessarily collide. This is true – at the micro level.

One understands the quest of e.g. France for economic growth, having experienced the misfortunes that a long period of almost zero growth leads to: budget cuts, loss of public service employees, too little investments, reductions in welfare spending, cutting back on culture projects, etc.

Development theory provides a key role to economic growth for the ambition of the Third World to *catch-up* with the First World. The recent surge in economic

growth is for instance the new economic giant countries are looked upon with envy by the European Union as well as the US (Table 1).

As is well-known, the GDP measures on income or production do not take environmental costs into account. Instead, polluting industries like the airline business, shipping and the car sector contribute considerably to the GDP. It has been argued that the GDP standard indicator should be revised to include the subtraction of ecology costs.

Now, the generation of total income or production for a year comes with the emission of greenhouse gases. Figure 1 portrays the close connection between GDP and total emission, using LN numbers for most recently available data.

Figure 1 shows that on the global macro level, the variation in economic development has strong implications for the emission of all four kinds of greenhouse gases: the richer and larger a country economy, the more emissions it releases. This finding is, of course, the

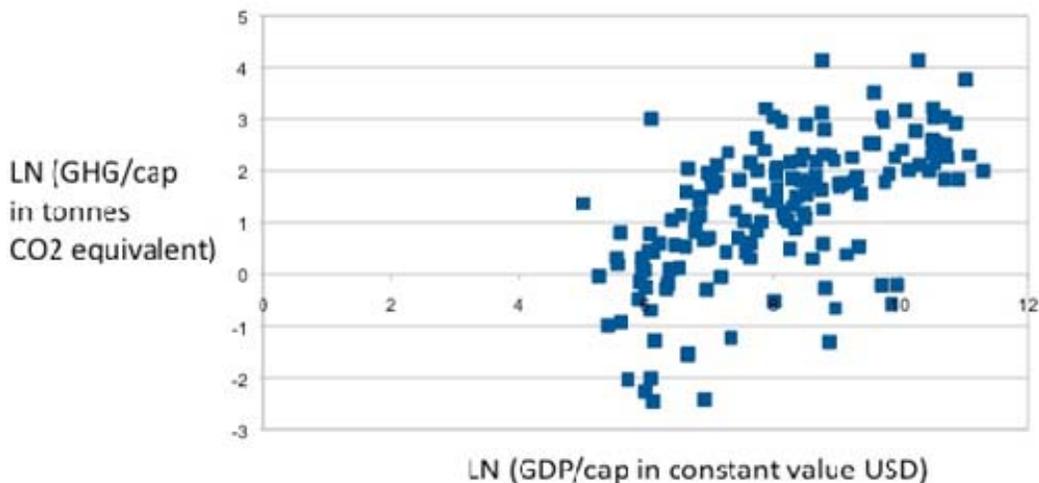


Figure 2. Emissions per capita and GDP per capita: Equation: $\text{LN GDP / CAP} - \text{LN GHG / CAP}: y=0.52x, R^2=0.370$. Note: GDP/capita vs. Greenhouse gas (GHG) emissions / capita for 158 countries in 2011. Sources: 1. World Bank Open Data, <http://data.worldbank.org>. 2. CAIT WRI 2.0: Climate Data Explorer, World Resources Institute, <http://cait2.wri.org>.

rationale for the basic argument that we need another kind of economic growth that builds upon carbon neutral technology. This is no doubt feasible in theory, but in practice we are stuck with the fossil fuel economy, especially after the turn to shale oil and gas. And the destruction of forests and depletion of fresh water sources continue.

At global reunions among the politicians and experts, there is much talk about the emissions per capita. Developing countries underline that they tend to display lower emissions per capita than advanced economies. Is this true? Figure 2 suggests an answer to the question of the distribution of the total greenhouse gases, which is a most policy relevant issue.

The finding, however, suggests strongly that emissions per capita is only weakly associated with GDP per capita. Thus, a few rich countries have rather low emissions, whereas some developing countries have substantial emissions per person. Thus, a global policy for ecological sustainability with regard to emissions control must be the responsibility of all countries on the globe, all people being concerned. It is true that a few rich countries have very high emission per capita (Gulf States, Australia, the US), but most of the emissions originate in the very populous countries in the world, especially in Asia, besides the US.

Economic development can be environmental friendly. Many micro projects have reduced carbon emissions and yet delivered goods and services more efficiently. However, what counts at the macro level is the overall addition and subtractions. Take the example for Singapore that is well aware of the energy-environmental conundrum. Although it must be admitted that Singapore is conducting many advanced projects to promote ecological sustainability, it should be pointed out that it is

a huge hub for air traffic and sea shipping, which both result in greenhouse gases. In addition, Singapore has coal fired power stations and consume huge amounts of electricity (water cleaning, waste treatment, air conditioning in almost all private housing and public buildings).

The same contradictory finding applies to the UAE where lots of investments are done in ecologically friendly projects. But the fact remains that the CO₂ emission per capita here is the largest in the world, like also in Qatar.

To understand the close link between total GDP and total emissions one needs to look at global energy consumption.

Energy consumption

Economic activity in all forms consumes directly or indirectly huge amounts of energy. This leads to the emission of greenhouse gases, directly or indirectly. To take a somewhat drastic example: the rapid increase in consumption of meat energy has resulted in an enormous growth of the number of cows in the world, which produce methane that is very conducive to climate change and global warming. Figure 3 shows the close connection between total GDP and total emission today.

It is also the case that rich countries consume more energy per person than poor countries, as higher levels of affluence require more energy – in general. Again, the situation is paradoxical, as rich countries can invest in environment friendly technology but they also consume more energy for upholding their lifestyle. Figure 4 has the finding.

More affluent or luxurious life styles are exhibited not only in bigger and stronger cars, but also in more heating and air conditioning. Electricity is much needed in affluent

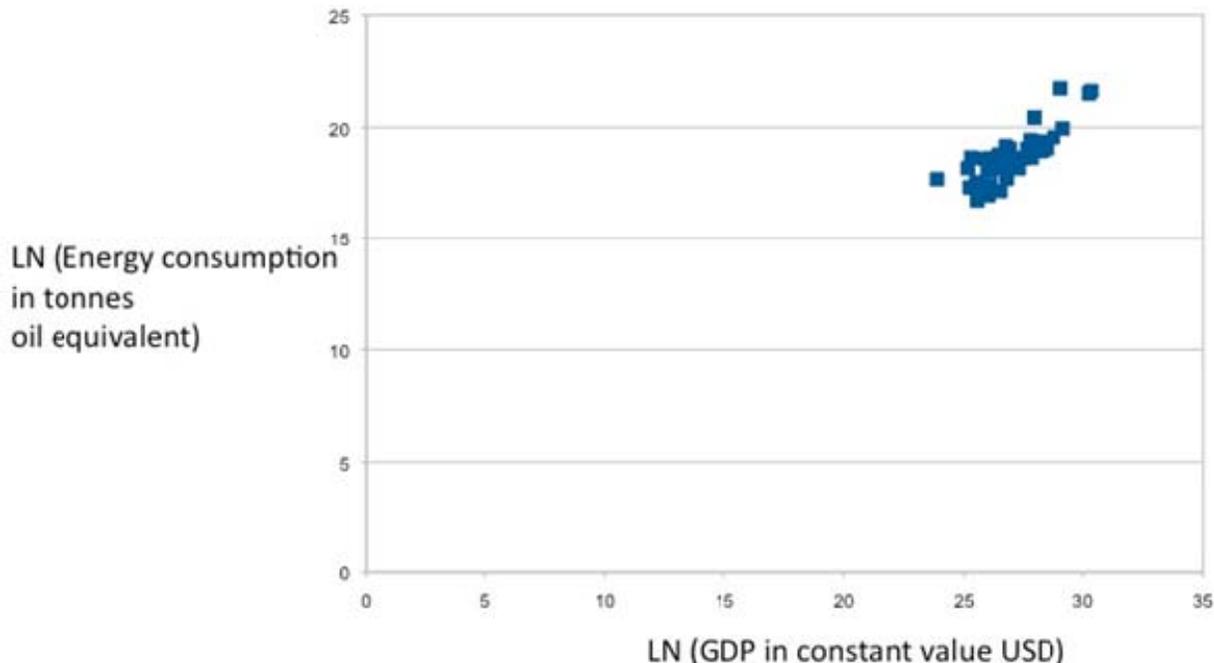


Figure 3. GDP and energy consumption: LN GDP - LN Energy consumption: $y=0.71x$, $R^2=0.695$.

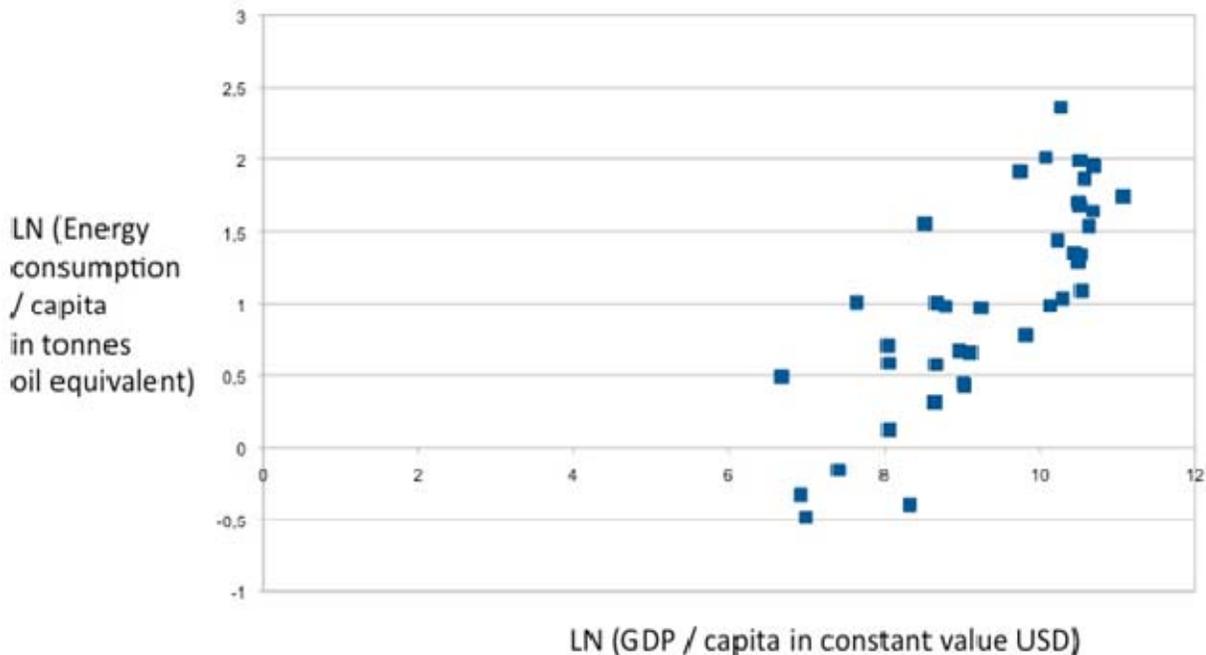


Figure 4. GDP per capita – emissions per capita: LN GDP / CAP - LN Energy consumption / CAP: $y=0.47x$, $R^2=0.641$.

countries. If it is not to be produced by nuclear energy, as in Germany, a country may actually rely more upon coal fired power stations with. As with Germany, massive amounts of imports of coal from developing countries, like Colombia with dismal ecological effects both abroad and at home.

THREE GLOBAL MODELS

Global ecological sustainability is not enhanced as long as total carbon equivalent emission increase, i.e. augments sharply year in and year out in reality. Two factors increasing greenhouse gases on the macro or

global level are world population and economic activity:

Equation I: Total greenhouse gases = LN GHG = $0.520 \cdot \text{LN GDP} + 0.477 \cdot \text{LN Pop}$, $R^2=0.76$.

This equation models the global situation today. One can imagine what happens to total greenhouse gases emissions and ecological sustainability when the world population reaches 9 billion and GDP doubles.

The major factor behind the increases year by year in greenhouse gases by some 3 per cent, besides many promising innovations, is the constantly augmenting need for energy. Other factors matter also, it is true, like the cutting or burning down of forests and the acidification of the seas and oceans. We look at the following equations finally:

Equation II. Ln Energy = $0.477 \cdot \text{LN Pop} + 0.43 \cdot \text{LN GDP}$, $R^2=0.88$.

Again, the increase in energy consumption predictions for the next coming two decades from Energy Information Administration (EIA: Annual Energy Outlook for 2014) mirrors the projected growth in world population and the optimistic scenario for economic production or the stylised economic growth rates of 3-5 per cent/year. I would suggest that the energy factor is the central one behind the global warming process, with is supported from the following equation:

Equation III. Ln GHG = $1.0109 \cdot \text{LN Energy} - 0.133 \cdot \text{LN Pop} + 0.1052 \cdot \text{LN GDP}$, $R^2=0.95$.

Energy consumption with rising levels of affluence has a stronger impact upon the emission of greenhouse gases than mere population growth in itself. However, when population increases are combined with more of energy in rising affluence, then emissions augment.

EMISSIONS: Levels and rates of increase

Recently in 2015, the EIA has published the message that “economic growth takes off but pollution stalls”. This information refers to a slight increase in GDP but CO2 emissions remain steady. However, this confounds level and rate of change. The yearly output of CO2 emissions is today at 30 gigatons. If this *level* of output continues for a decade or more, global warming will not halt at 2 degrees plus. Whether it increases a few percentages one year or another will not change the human predicament: rising temperature, desertification, acidification, fresh water shortages, etc. Should the present level of CO2 emissions continue yearly for more than a decade, then the danger of a 6 per cent increase in global temperatures is not improbable.

Conclusion

The G20 group of states and governments need to do something to promote the use of energy from renewable resources. As they represent almost 80 per cent of global country population, the G20 could embark upon an ecologically sustainable energy policy without either free riding or the kind of massive transaction costs that have plagued the UN efforts thus far. Changing the energy patterns is the only realistic option, as the quest for economic growth emerges from an unstoppable human drive.

One can look upon Planet Earth as a gigantic common pool. Managing the resources in this common pool presents so severe collective action problems that mankind has yet to find a policy mix that can “fix” the problems. Otherwise, we face the most dismal “tragedy of the Commons” ever. It is up to the governments of the large, populous and economically strong to find and implement coordination mechanisms that reduce the economic dependency upon fossil fuels. There is no guarantee against a major coordination failure, for instance in Paris Nov and Dec this year.

Approaching Planet Earth as a giant common pool with an atmosphere necessary for life, one must not assume that teleology will somehow stop free riding and renegeing, preventing coordination failure (Ostrom, 1990). The mere need for action, policies and coordination will not call forth institutions and enforcement or policing.

The city of Shanghai boasts that it has succeeded in building a large coal fired power plant that emits no greenhouse gases. Fine! To create of global *common pool regime* (CPR) of all cities burning coal for electricity in order to rebuild them without CO2 emissions would require much more than “voluntary cooperation”.

Conflict of Interests

The author has not declared any conflict of interest.

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